Abstract

Title: Analysis of Climate Model Outputs
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Regional climate models are currently the most important tools regularly used for downscaling outputs of global climate models. This analysis compares control and future runs of the global climate models HadCM3, ECHAM5/OPYC3 and ARPÉGE/OPA and the regional climate models RCAO, RCA3, HIRHAM4, HIRHAM5 and ALADIN-CLIMATE/CZ with observed data and CRU data for the Czech Republic. In the period 1961–1990, the global climate models underestimated the air temperature in comparison with corresponding virtual time series representing real data; mean annual courses and variance of the temperature, on the other hand, were simulated satisfactorily. The results of the regional climate models showed overestimation of the model temperature in winter season, while in other seasons the model temperatures corresponded better with real values and the results of simulation were generally more accurate in comparison with global climate models. Concerning mean temperature in the Czech Republic best performed the model ALADIN-CLIMATE/CZ. The last part of the study includes the most important results. The model outputs were analyzed using a non-linear descriptor, time-delayed average mutual information (MVI), which is only rarely used in analysis of meteorological time series. MVI was calculated for daily time-series of each grid point of the model domains and for selected meteorological stations of the Czech Republic with a time lag ranging from 1 to 20 days. The results showed an increase of MVI values from west to east of the Czech Republic with the highest values at south Moravia. This increase was observed in the reference period 1961–1990 and also in the future period 2071–2100, but it did not appear in station data. The station data well correlated with the altitude of the meteorological station; as the altitude increased, MVI value decreased. Comparison of reference and future periods of the models HIRHAM4 and RCAO showed that future runs are more persistent (the intra-daily coupling of temperatures were stronger than in recent runs). However, newer versions HIRHAM5 and RCA3 and the model ALADIN-CLIMATE/CZ yield different results with less persistence of future temperatures. Calculation of daily and monthly means of temperature revealed higher ability of MVI to describe intra-daily and intra-month coupling of temperatures than that of the autocorrelation function. Finally, MVI was calculated on the basis of E-OBS data over Europe. The results showed dependence of MVI on the exposition to the westerlies from the Atlantic Ocean and on advection of frontal systems and storms from the ocean. Average mutual information could also be recommended for tests of persistence of time-series, despite all negative properties mentioned in the study.